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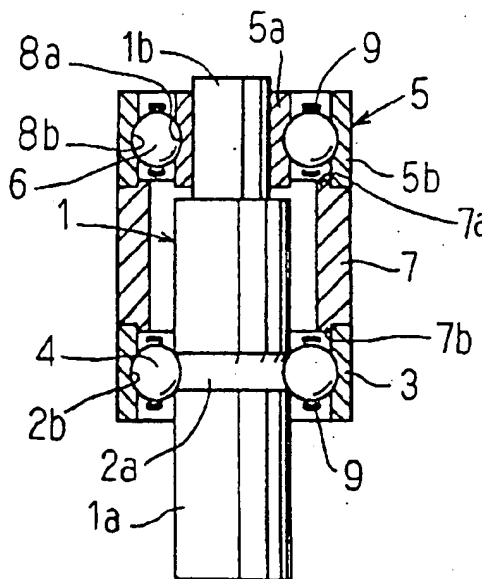
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(54) Compound bearing assembly for the swing arm of a hard disc drive

(57) A compound bearing assembly for a swing arm (13) of a hard disc drive is disclosed, which comprises a stepped shaft (1) having a first portion (1a) with a larger diameter than a second portion (1b), the larger diameter portion (1a) having an inner raceway groove (2a) directly formed in the outer periphery thereof. A distinct outer race ring (3) is disposed around the larger diameter portion (1a) and has an outer raceway groove (2b) formed in the inner periphery thereof. A plurality of balls

are provided between the inner and outer raceway grooves (2a) and (2b), a ball bearing unit (5) having an inner and an outer race ring (5a) and (5b) and a plurality of balls (6) provided therebetween. The inner race ring (5a) is fitted on the smaller diameter portion (1b) of the stepped shaft with a sleeve-like spacer (7) between the outer race ring (3) and the outer race ring (5b) of the ball bearing unit (5). The spacer has opposite end small-diameter portions, on which the outer race rings (3) and (5b) are fitted, respectively.

FIG. 1



Description

This invention relates to a compound bearing assembly for supporting a swing arm of a hard disc drive.

A prior art hard disc drive as shown in Fig. 3, comprises a magnetic disc 10 which is driven for rotation by a motor M, and a swing arm (or head arm) 12 carrying at the end thereof a magnetic head 11 for writing data in the disc 13 at a predetermined position thereof and reading out data from the disc 13 at a given position thereof.

The swing arm 13 has a stem rotatably supported by a compound bearing assembly which uses two ball bearing units. As shown in Fig. 4, a prior art bearing assembly for supporting the swing arm comprises two ball bearing units A and B and a sleeve-like spacer C. These components of the bearing assembly are produced separately and supplied to the user, e.g. the hard disc drive manufacturer or the swing arm manufacturer, to be assembled on a shaft D.

In other words, with the conventional swing arm support bearing assembly, the user has to assemble the two ball bearing units on the shaft via the spacer. This poses the following problems.

- (a) The shaft has to be manufactured so as to match the inner diameter of the inner race rings of the ball bearing units. In addition, its rigidity is subject to restrictions.
- (b) The spacer which is a separate component from the two ball bearing units, must be highly accurately produced, with parallel and flat opposite end finished surfaces.
- (c) Since the spacer is only fixedly interposed between the outer race rings of the two ball bearing units, it is necessary for the user to highly accurately assemble the assembly so as to have the sleeve and the shaft coaxial with each other.

For the above reasons, the assembly is not easily assembled by the user.

An object of the invention is to provide a compound bearing assembly, which addresses the problems discussed above. It is an advantage of the invention that the assembly can be directly used on a swing arm of a hard disc drive, by a hard disc drive manufacturer or a swing arm manufacturer.

A compound bearing assembly for a swing arm according to the invention, comprises a stepped shaft having a large diameter portion and a small-diameter portion, the larger diameter portion having an inner raceway groove directly formed in the outer periphery, a distinct component outer race ring disposed around the large-diameter portion and having an outer raceway groove formed in the inner periphery, a plurality of balls provided between the inner and outer raceway grooves, a ball bearing unit having an inner and an outer race ring and a plurality of other balls provided therebetween, the in-

ner race ring being fitted on the small-diameter portion of the stepped shaft, and a sleeve-like spacer surrounding a portion of the stepped shaft between the distinct component outer race ring and the outer race ring of the ball bearing unit and having opposite end small-diameter portions, the distinct component outer race ring and the outer race ring of the ball bearing unit being fitted on the opposite end small diameter portions, respectively.

In an embodiment of the invention, the inner race ring of the ball bearing unit has an equal outer diameter to the outer diameter of the large-diameter portion of the stepped shaft, and the outer race ring of the ball bearing unit has equal outer and inner diameters to the outer and inner diameters, respectively of the large-diameter portion, so that all the balls are the same in diameter.

Embodiments of the present invention will now be described, by way of example, with reference to the accompanying drawings, in which:-

Fig. 1 is a sectional view showing a compound bearing assembly in a first embodiment of the invention; Fig. 2 is a perspective view showing a hard disc drive;

Fig. 3 is a sectional view showing a swing arm supported by a compound bearing assembly in accordance with the invention; and

Figs. 4(a) and 4(b) are sectional views showing a prior art swing arm bearing assembly, Fig. 4(a) showing ball bearing units and a spacer before being assembled, Fig. 4(b) showing the ball bearing units and spacer having been assembled on a shaft.

Referring to Fig. 1, a stepped shaft 1 has a first portion 1a which is larger in diameter than a second portion 1b, the larger diameter portion 1a having an inner raceway groove 2a formed directly in the outer periphery thereof.

An outer race ring 3 is provided around the large diameter portion 1a and assembled on the same with a plurality of balls 4 provided between an outer raceway groove 2b formed in its inner periphery and the inner raceway groove 2a in the larger diameter portion 1a.

A ball bearing unit 5, which has an inner and an outer race ring 5a and 5b and a plurality of balls 6 provided therebetween, has the inner race ring 5a fitted on and secured to the smaller diameter portion 1b of the stepped shaft 1.

A sleeve-like spacer 7, surrounds the stepped shaft 1 and has opposite end small-diameter portions 7a and 7b with the outer diameter thereof set for snug fitting in the outer race ring 3 and the outer race ring 5b of the ball bearing unit 5. The term small-diameter portion herein refers to end portions of the spacer 7 of a smaller diameter than the main body of the spacer. The spacer 7 has its small-diameter portions 7a and 7b fitted in and secured to the outer race rings 3 and 5b.

The inner race ring 6a of the ball bearing unit 5 has a diameter equal to the outer diameter of the larger di-

ameter portion 1a, and the outer race ring 5b of the ball bearing unit 5 has equal outer and inner diameters to the outer and inner diameters, respectively, of the outer race ring 3 around the larger diameter portion 1a.

Raceway grooves 9a and 9b are formed in the inner and outer race rings 5a and 5b of the ball bearing unit 5, and located by ball retainers 9.

In constructing the assembly the inner race ring 5a of the ball bearing unit 5 is slidably fitted on the smaller diameter portion 1b of the stepped shaft 1, then an adequate pre-load is applied to the outer end surface (i.e., the upper end surface in Fig. 1) of the inner race ring 5a, and in this state the inner race ring 5a is secured by means of an adhesive to the small-diameter portion 1b of the stepped shaft 1.

In this way, the spacer and the outer race rings at the opposite ends thereof are coupled together into a sleeve-like outer race ring of the compound bearing assembly, and the outer ring, the spacer, and the ball bearing unit are assembled on the stepped shaft.

In the above embodiments, all the balls were the same in diameter, but it is possible to use balls having different diameters for the sides of the larger and smaller diameter portions, respectively.

The shaft of the compound bearing assembly thus obtained is projected from a base member of a hard disc drive by securing a stem of its larger-diameter portion to the base member. Then, a boss 13 of a stem of a swing arm 12 is fitted on and secured by means of an adhesive to the sleeve-like outer race ring.

The swing arm which is thus mounted on the compound bearing assembly thus can be rotated about the shaft thereof.

With a compound bearing assembly having the above construction, the following functions and effects are obtainable.

(a) Since the compound bearing assembly spacer and the outer race rings at the opposite ends thereof are coupled together into a sleeve-like outer race ring and the outer race ring, the spacer, the ball bearing unit and the balls are assembled on the shaft, the user need not assemble any of these components, and the compound bearing assembly can be readily and reliably mounted on a swing arm of a hard disc drive by fitting the swing arm stem boss 13 on and securing the same by means of an adhesive to it.

(b) Since the inner raceway groove is formed directly in the outer periphery of the larger diameter portion of the stepped shaft in the bearing assembly, the conventional inner race ring is unnecessary, and correspondingly the shaft is partly increased in diameter producing a stepped shaft, which thus has increased rigidity.

(c) The spacer can be fabricated highly accurately by the bearing assembly manufacturer such that it conforms to the dimensions of the ball bearing unit.

In addition, since the opposite end small-diameter portions of the spacer are fitted in and coupled to the outer race rings into the sleeve-like outer race ring of the compound bearing assembly, the accuracy of the coaxial coupling of the spacer, the outer rings and the shaft, and hence the accuracy of general assembly of the device, can be improved.

(d) Only a single conventional ball bearing unit, and hence only a single inner race ring, is needed, and it is possible to provide a bearing assembly having a reduced number of components.

Claims

1. A compound bearing assembly for a swing arm (13) of a hard disc drive comprising:

a stepped shaft (1) having a first portion (1a) with a larger diameter than a second portion (1b), said larger diameter portion (1a) having an inner raceway groove (2a) formed directly in the outer periphery thereof;

a distinct outer race ring (3) being disposed around said larger diameter portion (1a) and having an outer raceway groove (2b) formed in the inner periphery thereof;

a plurality of balls (4) provided between said inner and outer raceway grooves (2a, 2b);

a ball bearing unit (5) having an inner and an outer race ring (5a, 5b) and a plurality of other balls (8a) provided therebetween, said inner race ring being fitted on said smaller diameter portion of said stepped shaft; and

a sleeve-like spacer (7) surrounding a portion of said stepped shaft (1) between said outer race ring (3) and said outer race ring (5b) of said ball bearing unit (5) and having opposite end small-diameter portions (7a, 7b), said outer race ring (3) and said outer race ring (5a) of said ball bearing unit (5) being fitted on said opposite end small-diameter portions (7a, 7b), respectively;

said outer race ring (3), said sleeve-like spacer (7) and said ball bearing unit (5) being thereby integrally assembled on said stepped shaft (1).

2. A compound bearing assembly as claimed in claim 1, wherein said inner race ring (5a) of said ball bearing unit (5) and the outer diameter of said larger diameter portion (1a) of said stepped shaft (1) have a substantially equal diameter, and said outer race ring (5b) of said ball bearing unit (5) have substantially equal outer and inner diameters to said larger diameter portion (1b).

FIG. 1

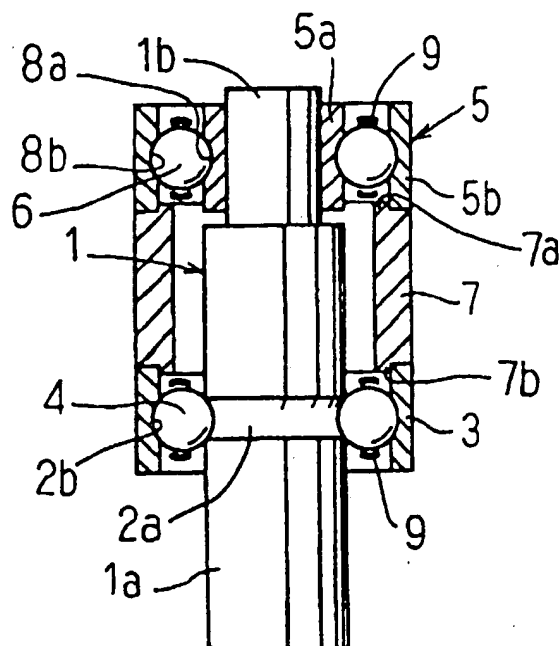


FIG. 2

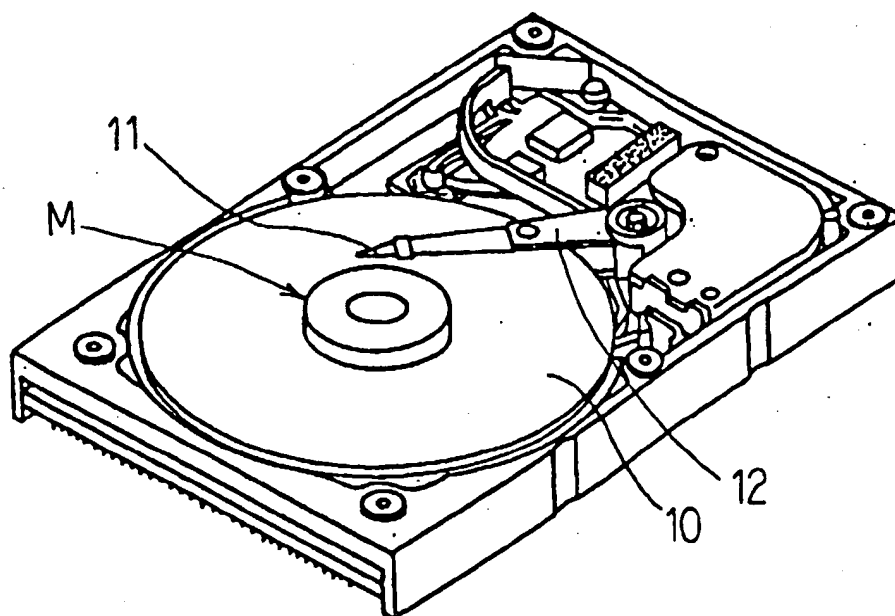


FIG. 3

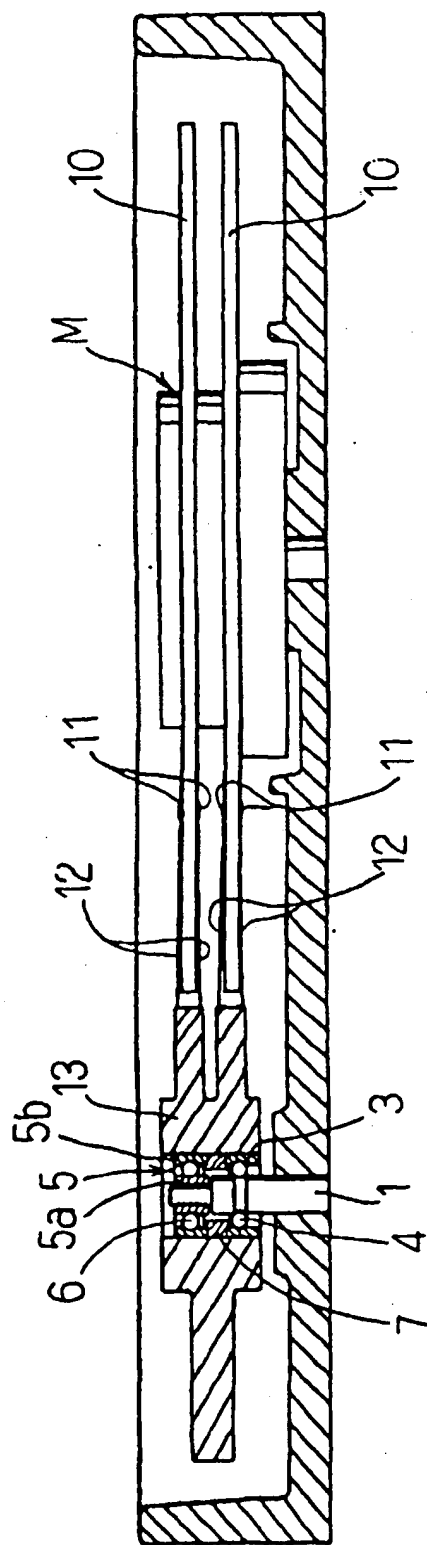


FIG. 4 (a)
Prior Art

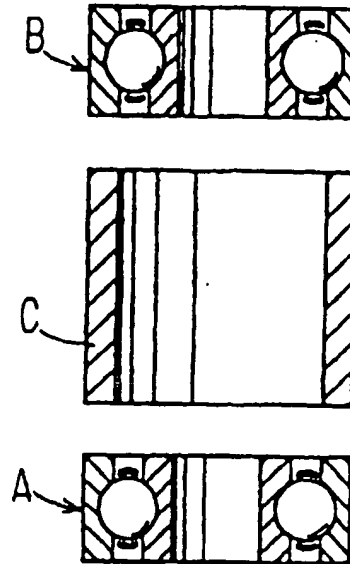
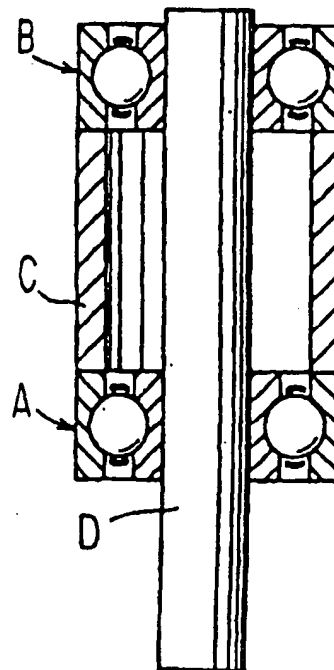
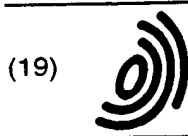


FIG. 4 (b)
Prior Art





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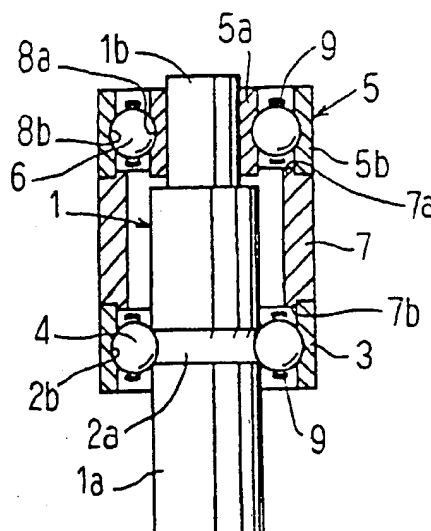
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FIG. 1





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EUROPEAN SEARCH REPORT

Application Number
EP 96 30 7657

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
Y	US 5 341 569 A (TAKAMIZAWA ET AL.) * column 6, line 64 - column 13, line 53; figures *	1,2	G11B21/12
Y	US 5 161 077 A (JABBARI) * column 2, line 44 - column 3, line 36; figures *	1,2	
A	EP 0 613 134 A (MINEBEA) * page 3, column 3, line 58 - page 4, column 6, line 36; figures *	1,2	
A	FR 2 565 017 A (GMN) * page 3, line 11 - page 4, line 17; figures *	1,2	
A	US RE34684 E (KITAHARA ET AL.) * column 4, line 60 - column 8, line 54; figures *	1,2	
A	US 5 099 374 A (OHKITA ET AL.) * column 4, line 11 - column 13, line 7; figures *	1,2	TECHNICAL FIELDS SEARCHED (Int.Cl.6) G11B
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 13 November 1997	Examiner Geoghegan, C
<p>CATEGORY OF CITED DOCUMENTS</p> <p>X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document</p> <p>T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document</p>			